

WATERSHED BASED PLAN

St. Jones River Watershed

1) Purpose

The contents of the St. Jones River Watershed Plan are intended to fulfill the elements of a Watershed Plan in compliance with the a) through i) criteria as established by EPA. The St. Jones River Watershed Plan is developed utilizing information found with the following documents:

- St. Jones Pollution Control Strategy – by the Department of Natural Resources and Environmental Control
- St. Jones River Baseline Report – by Duffield Associates, Inc.
- St. Jones River Watershed Implementation Plan – by Duffield Associates, Inc.
- St. Jones River Watershed Pollution Control Opportunities Technical Memorandum – by Duffield Associates, Inc.
- State of Delaware - 2010 Combined Watershed Assessment Report (305(b)) and Determination for the Clean Water Act Section 303(d) List of Waters Needing TMDLs

2) Watershed Background

The St. Jones River Watershed is approximately 25.9 mi² (16,576 acres) and contains the lower portion of the St. Jones River. The southeastern portion of this Watershed is in the Lower St. Jones River Reserve (the Reserve). This Watershed has the largest percentage of protected lands 5,236 acres with the River Reserve totaling approximately 3,750 acres of the protected lands. The Watershed land use is dominated by agriculture (33%), followed by wetlands (25.5%), and residential lands (17.4%). The impervious cover in the Watershed is approximately 9.8% with a possible future impervious cover of 23%. Between 2002 and 2007 agricultural lands decreased by 4% and residential lands increased by 2.1%. Wetland slightly decreased by 0.7% as did forested land by 0.1%.

3) Land Use

The Watershed is located in Kent County, Delaware, with the Delaware Bay along its eastern border, the Choptank River Watershed of the Chesapeake Basin to its west, the Leipsic River and Little Creek Watersheds to the north and northeast, respectively, and the Murderkill Watershed to its south. Kent County is the middle of three (3) counties in Delaware, located within the Coastal Plain Physiographic province (see Table 1). The Watershed is predominantly agricultural (38%) with almost 25% urban/residential.

Table 1

Watershed Statistic	1997	2007	Change
Agriculture	44.66%	38.13%	-6.53%
Barren/Open	1.37%	1.9%	0.53%
Urban	3.66%	4.06%	0.41%

Commercial	3.18%	2.88%	0.08%
Extraction	0.48%	0.59%	0.11%
Forest Land	9.81%	8.41%	-1.4%
Industrial	0.95%	1.11%	0.16%
Recreational	1.45%	1.83%	0.38%
Residential	16.02%	21.31%	5.29%
Transportation	1.37%	1.54%	0.17%
Utilities	0.03%	0.12%	0.09%
Wetlands/Water	2.18%	2.76%	0.58%

4) Summary of Existing Conditions

Table 2 contains the reaches included on the 303(d) impaired list. The Watershed benefits from the Reserve in the south; however, development in the upper portion has impaired the quality of the lower St. Jones River. Eight miles of the lower St. Jones River is listed for bacteria, DO, and nutrients. The two (2) streams in the St. Jones River Watershed, the Lower St. Jones and Cypress Branch that were completed during a field assessments scored as marginal overall.

Table 2

Sub-watershed	Segment	Length/ Size	Impairments	Probable Source
St. Jones	Lower St. Jones	8.3	Bacteria, DO**, nutrients	NPS*
Tidbury Creek	Tidbury Branch	3.8	Bacteria, DO, nutrients	NPS
	Derby Pond	23.1	Bacteria, nutrients	NPS
Isaac Branch	Isaac Branch	9.1	Bacteria, DO, nutrients	NPS
	Moores Lake	27.1 ac	Bacteria, DO, nutrients	NPS
Silver Lake	Upper St. Jones	6.7	Bacteria, DO, nutrients	NPS
	Fork Branch	7.7	Bacteria, DO, nutrients	NPS
	Silver Lake	157.8 ac	Bacteria, nutrients	NPS

5) Impairment Listings

Section 303(d) of the Federal Clean Water Act (CWA) requires States to develop a list [303(d) List] of water bodies for which existing pollution control activities are not sufficient to attain applicable water quality standards and to develop Total Maximum Daily Loads (TMDLs) for pollutants of concern. A TMDL sets a limit on the amount of a pollutant that can be discharged into a water body such that water quality standards are met.

The State established TMDLs for the St. Jones River Watershed in December 2006. DNREC's target reduction for the existing pollutants in the Watershed, as a result of various load reduction analyses, is 40% non point source reduction of nitrogen and phosphorous (nutrients) and carbon (BOD), and 90% non-point source reduction of enterococcus (bacteria or pathogen). The non-point source load reductions will be coupled with point source reductions. The point sources identified in the Watershed are in the Silver Lake sub-watershed, Reichhold Chemicals and Dover McKee Run Power Plant.

The studies reviewed state that the current condition of the Watershed is of degraded quality. Water quality samples have shown that the impairments (parameters) affect approximately 35.6 miles of streams and 208 acres of ponds. These impairments are primarily caused by nonpoint sources (DNREC, 2006). Silver Lake has been impaired by planktonic algae. Moores Lake has also been impaired by planktonic algae to a lesser degree than Silver Lake. Data has not been provided for Wyoming Lake. The segments (1998, 2002, 2004 and 2006 Draft 303(d) Lists) were listed as impaired by pollutants. Impairments include dissolved oxygen (DO), nutrients, and bacteria.

6) St. Jones TMDL

a) Introduction and Background

Water quality monitoring performed by the Department of Natural Resources and Environmental Control (DNREC) has shown that the waters of St. Jones River and several of its tributaries and ponds are impaired by high levels of bacteria and elevated levels of the nutrients nitrogen and phosphorous, and that the designated uses are not fully supported due to levels of these pollutants in these waterways.

Section 303(d) of the Federal Clean Water Act (CWA) requires States to develop a list (303(d) List) of waterbodies for which existing pollution control activities are not sufficient to attain applicable water quality criteria and to develop Total Maximum Daily Loads (TMDLs) for pollutants or stressors causing the impairment. A TMDL sets a limit on the amount of a pollutant that can be discharged into a waterbody and still protect water quality. TMDLs are composed of three components, including Waste Load Allocations (WLAs) for point source discharges, Load Allocations (LAs) for nonpoint sources, and a Margin of Safety (MOS).

b) Specific Goals

Limit pollutants to levels at or below the Total Maximum Daily Load (TMDL) values specified in the regulation, i.e., an overall reduction of nitrogen and phosphorus in the waterways by 40%, or 869.5 lbs per day for nitrogen and 63.4 pounds per day for phosphorus. Nonpoint sources, which this plan addresses, must reduce total nitrogen from 838.5 lbs per day and total phosphorus from 52.9 lbs per day (refer to Table 3). The TMDL also calls for 21.8 lbs per day reduction of nitrogen and 3.4 lbs per day from its stormwater (MS4) discharges.

Table 3

	TN (lbs/day)	TP (lbs/day)
Total Needed Reductions	838.5	52.93

Table 4

Load Reduction	TN (lbs/day)	TP (lbs/day)
Urban	140.18	10.25
Septic	58.36	19.4
Ag - Current	502.88	16.96
Ag – Future Needs	275.85	6.32
Totals	977.27	52.93

7) Impairments

There are a total of 8 listed water segments within the St. Jones River Watershed: 2 tidal segments of the St. Jones River; 3 freshwater stream segments; and 3 freshwater lakes or ponds. These segments are listed for the following impairments:

- nutrients,
- DO, and
- Bacteria

The most probable source of pollutants identified as NPS. The TMDL development in the St. Jones River Watershed was completed to address these water quality impairments and present TMDLs that are aimed at improving water quality in the listed segments.

Land use information for the year 2002 was obtained from DNREC and is presented in the table below. The St. Jones River Watershed is approximately 57,645 acres (90 mi²) and is primarily non-urban (70%) with approximately 40% agricultural land use. The associated impairments are additionally identified in the table below.

Source	TN (lbs/acre/year)	TP (lbs/acre/year)	TN (lbs/yr)	TP (lbs/yr)	Area
Urban	10.24	1.25	196,596.15	23,998.55	19,198.4
Agriculture	13.19	1.25	284,740.78	26,984.53	21,587.63
Forest	6.51	0.05	31,611.88	242.79	4,855.89
Wetland	0.00	0.00	0.00	0.00	8,685.97
Water	0.00	0.00	0.00	0.00	1,550.99
Range	7.50	0.45	2,403.58	144.21	320.48
Other	7.50	0.45	10,642.90	638.57	1,419.05

8) Potential Targeted Opportunities

The St. Jones sub-watershed could benefit from:

- Additional preservation/restoration in the western area of the sub-watershed;
- Retrofits in the urbanized sections; and

- Water quality prevention (agricultural best management practices and other watershed management technologies) in the upper portion of the sub-watershed.

9) Summary of Urban Recommendations

Desired Load Reduction: 140 lbs/day TN and 10.25 lbs/day TP

	Goal (Acres)	Cost	Load Reduction TN Goal (lbs/day)	Load Reduction TP Goal (lbs/day)
Urban Buffers	1,972.00	\$115,000	112.85	9.89
Grassed Open Space	665.00	\$39,000	27.33	0.36
Totals			140.18	10.25

a) General

- The Department should support the hire of a local Watershed Coordinator to facilitate the implementation of both Urban and Agriculture BMPs throughout the St. Jones's Watershed.

Cost: 1 FTE @ an estimated at \$35,000 annual

Funding: State General Funds through the Watershed Assessment Section, ARRA funds, and/or Section 319 Grant.

b) Buffers

- The Department should develop a St. Jones Watershed buffer overlay map to ensure buffers are in place throughout the watershed to improve water quality. This overlay map should be developed in cooperation with local municipalities and used to coordinate efforts among jurisdictions and must consider urban (developed) and rural (undeveloped) settings.

Cost: Estimated at \$10,000

Funding: State General Funds through the Watershed Assessment Section

- A 100 foot vegetated or forested riparian buffer zone should be required within the watershed for all water bodies. However, this requirement should not apply to agricultural lands. Measurement should be from the edge of the bank of the water body landward.

Cost: \$115,000

Funding: State General Funds through the Watershed Assessment Section, ARRA funds, and/or Section 319 Grant.

- If a buffer cannot be placed within a project or an existing buffer area is reduced during development, the lack of the buffer should be mitigated. The Department should develop the criteria for compensation and a selection of alternatives which can be used as compensation. The criteria should consider both urban and rural settings and provide equivalent nutrient reductions (1:1 ratio).

Cost: Estimated \$0

Funding: NA

- Vegetation within the buffer should be made up of “recommended plantings” of native species. However, the type of plantings should not be mandated. A minimum density of plantings is required to ensure water quality benefits.

Cost: Estimated \$0

Funding: NA

- Buffers should be maintained in perpetuity and should be managed to maintain water quality benefits. Use of easements in this regard is encouraged.

Cost: Estimated \$0

Funding: NA

- In all common areas, boundary signs should be installed to identify the buffer and its boundary. However, signs are not required on private property.

Cost: Estimated \$0

Funding: NA

- Buffer compliance should be the responsibility of the Kent County Conservation District during its planning and review process. The Department should initiate discussions with the District about this recommendation. (However if a stormwater utility is implemented, as the Team recommends, buffer compliance could be linked into this effort.)

Cost: Estimated 0.5 FTE @ \$15,000 annual

Funding: State General Funds through the Watershed Assessment Section and/or Section 319 Grant.

c) **Open Space**

- A. Land maintained as passive or active open space under local ordinances or codes should be managed to minimize nutrient loading.

Cost: Estimated \$10,000

Funding: State General Funds through the Watershed Assessment Section or the Delaware Department of Agriculture Forestry Section, and/or Section 319 Grant.

- B. Home Owners' Association members should be educated on caring for open space in their neighborhoods to minimize nutrient loading and encourage natural habitat.

Cost: Estimated 0.25 FTE @ \$7,500 annual

Funding: State General Funds through the Watershed Assessment Section and/or Section 319 Grant.

d) Stormwater

- A. A stormwater utility should be implemented to generate a stable source of funding for stormwater management within the watershed.

Cost: Estimated \$0

Funding: NA

- B. Stormwater Best Management Practices (BMPs) should be designed to reduce nutrients according to TMDLs.

Cost: Estimated \$0

Funding: NA

- C. Local municipalities, Kent County Conservation District and Kent County should meet to determine how to limit the addition of new impervious cover to less than 20% of the watershed to conserve water quality. During the review process, the use of pervious surfaces should be encouraged.

Cost: Estimated \$0

Funding: NA

- D. Local municipalities and Kent County should adopt regulations to promote Low Impact Development (LID) in new construction and redevelopment. The team recommends the use of tax incentives where possible.

Cost: Estimated \$0

Funding: NA

- E. A stormwater inventory should be conducted to identify areas where stormwater retrofits would effectively reduce sediment and nutrients.

Cost: Estimated 0.33 FTE @ \$10,000

Funding: State General Funds through the Watershed Assessment Section and/or Section 319 Grant.

- F. Since Home Owners Associations are critical for successful stormwater BMP maintenance, there should be a governmental agency charged with making sure the

Associations are functional. In the Association by-laws, there should be a requirement for stormwater education.

Cost: Estimated \$0

Funding: NA

10) Summary of Septic Recommendations

Best Management Practices (BMPs) for septic systems are encouraged and supported. New funding sources should be sought and financial incentives should be increased. The BMPs listed in the table below should be considered.

Desired Load Reduction: 58.36 lbs/day TN and 19.4 lbs/day TP

	Goal	Cost	Load Reduction TN Goal (lbs/day)	Load Reduction Tp Goal (lbs/day)
Sewer System Repair	NA	\$35,000	Unknown	Unknown
Septic Inspection and Pump Out	3,287 units annually	NA	14.1	5.4
Cesspool/Seepage Pit Elimination	30 units	NA	0.16	0.6
Sewer Connection	91 units annually over next 10 years	NA	30.0	8.0
Septic BAT	3,287 units	NA	14.1	5.4
Totals			58.36	19.4

- a) **Sewer System Repair:** Sewer Transmission Systems should be repaired to reduce infiltration and inflow during wet periods.

Basis of Recommendation: Based upon information given to the Team, flow to the county wastewater treatment plant may double during rain events and nutrient loads may increase from more runoff. It is estimated that Dover residents are paying at least \$100,000 a year just to treat rainwater that has infiltrated into Dover's collection system. In the fall of 2006, Dover contracted with Video Pipe Services of Beltsville, Maryland to determine areas where the sewer collection system needs repairs in order to eliminate infiltration.

Cost: Estimated at \$35,000 annual

Funding: City of Dover

Reduction of N: Unknown

Reduction of P: Unknown

- b) Septic Inspection and Pump Out:** Onsite Wastewater Treatment and Disposal Systems (OWTDSs) should be inspected and pumped out regularly to reduce nutrient loading of the groundwater. Compliance with current regulations should be promoted.

Basis of Recommendation: Currently septic permits require that the systems be pumped out every three years or when the system contains 30 percent or more of solids. The County and/or Department should institute a program that enforces the inspection and pump-out requirement for onsite septic systems. A notification system should be developed such that homeowner's would be notified of this requirement in the year their system is due to be inspected. The County and State should use computer software to track the occurrence of inspections and cooperate to ensure compliance with regulations. The program should assist residents who have not had their septic pumped in the previous two years to have their system pumped and inspected. The State and County should subsidize the cost of inspection and pump out. Following the inspection, the inspector should provide the homeowner/resident with educational materials and receipt of pump out.

By requiring this before closing, new property owners will be educated on their system and gain a better understanding of maintenance and operation requirements, thus reducing long term or future problems with the system. Section 8.0000 of the "*Regulations Governing the Design, Installation and Operation of On-site Wastewater Disposal and Treatment Systems*" dictates owner responsibility for maintaining and operating on-site wastewater treatment and disposal system.

The watershed currently has 9,860 OSD systems within its boundaries. If all systems are pumped once every three years, as required by State regulations would result in 3,287 systems would be pumped annually.

Cost: Regulatory Cost

Funding: Septic System Owners

Reduction of N: 14.1 lbs/day for 3,287 systems

Reduction of P: 5.4 lbs/day for 3,287 systems

- c) Cesspool Elimination:** Cesspools and seepage pits should be eliminated systematically as these wastewater systems discharge nutrients and bacteria directly into the groundwater. The septic inspection and maintenance program should help locate and eliminate them.

Basis for Recommendation: The DNREC Watershed Assessment Section estimates that there are at least 30 cesspools and/or seepage pits in the St. Jones Watershed, however that estimation may be low. Any existing cesspools would likely be with old farmsteads and very old mobile home parks.

Cost: Regulatory Cost

Funding: Septic System Owners

Reduction of N: 0.16 lbs/day of TN for 30 cesspools

Reduction of P: 0.6 lbs/day of TP for 30 cesspools

- d) **Sewer Connection:** If it is physically and legally available (as defined by the regulations governing the design, installation and operation of OWTDSs), OWTDSs should be removed in growth zones and connected to Kent County Wastewater Treatment Facility. Through the inspection and maintenance program, failed systems should be identified for connection to sewer. As reviewed, 910 units exist that fall within Districts that could be adequately served by sewer.

Basis for Recommendation: In Delaware, surface and ground water are directly connected. Consequently, impacts on groundwater will impact the quality of the surface water. In the summer, surface water flow is primarily groundwater seepage into the stream. Nutrients from onsite wastewater treatment and disposal systems will reach the surface water through the groundwater.

Kent County has targeted Walnut Shade area, where 500 residences are served with onsite wastewater treatment and disposal systems, for connection to central sewer. Many of these systems are old and are malfunctioning. Kent County has also included Woodville and Terry Drives, an area where most of the homes are served by environmentally ineffective and outdated cesspools, in this expansion. This area was included because system failures pose the greatest threat to human health and water quality. This proposed sewer district will be connecting to Kent County Treatment Facility within the next 3-5 years.

Cost: Regulatory Cost

Funding: Septic System Owners

Reduction of N: 30 lbs/day of TN

Reduction of P: 8 lbs/day of TP

- e) **Septic BAT:** If an OWTDS fails, it will be identified through the inspection and maintenance program. To obtain a new permit, the system will be required to use the best available “new technology” to achieve required nutrient reduction targets for the watershed.

Basis for Recommendation: In response to the TMDL, Kent County requires that new individual residential, large or community onsite sewage treatment and disposal systems sited in a watershed with an established Total Maximum Daily Load (TMDL) shall be designed and installed in accordance with the nutrient load reductions prescribed by the TMDL or they shall use the best available technologies in order to achieve the required nutrient reduction targets set for the particular watershed. (See Chapter 187, Subdivision and Land Development (Adopted June 24, 2003)). New homebuyers may not understand the functioning of their system or the impacts a failing system could have on the environment. Therefore, by providing education materials, the homeowner may prevent long-term problems and may save money as well.

Due to the cost of these systems the Financial Assistance Branch administers low interest loans for on-site wastewater systems for persons of low to moderately low incomes from the State Revolving Fund.

EXPECTED REDUCTION: Funds from the 6217 Coastal Nonpoint Source Program and the 319 Nonpoint Source Program were used to pilot a compliance and inspection program for on-site wastewater disposal systems. The program provided cost-share funds for homeowners to have their septic systems pumped and employed an inspector to inspect individual residential systems and educate the homeowner about their system and how it should function and be maintained. A total of 210 septic systems were pumped out and inspected. Seventy percent were in satisfactory condition. Thus in Sussex County there was a 30% failure rate. If this rate was applied to the St Jones Watershed, there would be a potential of 3,287 failed septic within the watershed.

Cost: Regulatory Cost

Funding: Septic System Owners

Reduction of N: 14.1 lbs/day for 3,287

Reduction of P: 5.4 lbs/day for 3,287 systems

11) Summary of Agriculture Recommendations

a) Recommended Agriculture Best Management Practices

Best Management Practices (BMPs) for agriculture are encouraged and supported. New funding sources should be sought and financial incentives should be increased. The following BMPs, in particular, should be considered for:

Desired Load Reduction: 778.73 lbs/day TN and 29.6 lbs/day TP

- **Cover crops** to protect soil when row crops are not being grown. This practice helps retain nitrogen in the soil for the next crop which reduces fertilizer costs to the farmer. Incentive payments for cover crops range between \$30 and \$40/acre and averages \$35/acre (personal communication, 2006). Several years ago, the Wye Research Center estimated that it cost \$27/acre to seed and plant cover crops each year, however, this value has likely increased in recent years due to inflation and rising fuel costs. The current incentive payment likely covers the cost of implementing this BMP. Additionally, farmers are allowed to harvest the cover crop for on farm use, so that there is no cost to the farmer. This practice costs \$2.81/lb TN reduction and \$890/lb TP reduction.

Cost: Estimated Up to \$4,000 annual

Funding: NRCS, Delaware Cost Share Program, DNREC Watershed Assessment, and/or NPS Program 319 Funding

- **CRP/CREP Grassed filter strips and grassed buffers** to trap sediments in surface runoff and take up excess nutrients. These CRP practices are estimated to cost \$300/acre for installation. The cost can be capitalized over the 10 year contract at a 3% interest rate to yield a cost of \$35.17/acre/year. Land is rented for \$65/acre/year and maintained at \$5/acre such

that the total expenses equal \$105.17/acre/year. This equates to \$12/lb TN and \$524/lb TP reduced for both best management practices. The installation of these BMPs are cost shared at a total rate of 87.5%, such that the farmer must pay \$4.40/acre/year of the capital costs. Reimbursement for land rental and maintenance provides for virtually zero cost to the farmer.

Cost: Estimated Up to \$4,000 annual rental rate
Estimated Up to \$11,400 annual installation
Funding: FSA CRP/CREP and/or Delaware CREP Program

- **CRP/CREP Ponds** established to capture nutrient losses from upland or cropped acreage. The cost of designing and establishing CRP Ponds is high if extensive earth movement is required. Costs may range from \$1,500/acre to \$3,000/acre. The average costs of actual restoration have been \$1,702/acre. Capitalized over 15 years, representing a single contract period, the actual cost per acre becomes \$142.57. Annual rental (\$138/acre/year) and maintenance (\$5/acre/year) fees bring the total cost of wetland restoration to \$285.57/acre/year. For nutrient reduction calculations, this BMP is treated as a land use change from agriculture to wetlands and each wetland acre is additionally assumed to treat 2 upland acres of cropland. Using reduction estimates, the above figure equate to \$6.80/lb TN reduced and \$204/lb TP. Assuming that established cost share levels for capital costs from FSA (50%) and the State (37.5%) remain the same as they were in 2003, the farmer will only be responsible for \$17.82/acre/year. After receiving the land rental and maintenance fees and incentives, the farmer pays nothing.

Cost: Estimated Up to \$900 annual rental
Estimated Up to \$9,000 installation
Funding: FSA CRP/CREP and/or Delaware CREP Program

- **CRP/CREP Riparian forested buffers** to reduce nutrient losses from upland acres and to reduce sediment bound phosphorous from entering waterways. The cost of installing a CREP forested buffer is estimated to range between \$125- \$725/acre, and averages about \$425/acre. If you capitalize that figure over 15 years at 3%, the annual cost is \$35.60/acre. Land rental (\$138/acre/year) and maintenance (\$5/acre/year) fees bring the total cost to \$178.60/acre/year. Total cost per pound of nutrient reduction is \$4.25/lb TN and \$128/lb TP reduced. Construction costs are cost shared at a rate of 87.5%, so that the cost to the farmers for BMP installation is \$4.45/acre/year. Once the farmer is compensated for taking the land out of production, reimbursed for maintenance and given incentives, the farmer bears no costs.

Cost: Estimated Up to \$72,165 annual rental rate
Estimated Up to \$30,555 installation
Funding: FSA CRP/CREP and/or Delaware CREP Program

- **Wetland Restoration** reduces nutrient loss from upland acres. The cost of restoring farmed wetlands is high if extensive earth movement is required. Costs may range from \$1,500/acre to \$3,000/acre. The average costs of actual restoration have been \$1,702/acre. Capitalized

over 15 years, representing a single CREP contract period, the actual cost per acre becomes \$142.57. Annual rental (\$138/acre/year) and maintenance (\$5/acre/year) fees bring the total cost of wetland restoration to \$285.57/acre/year. For nutrient reduction calculations, this BMP is treated as a land use change from agriculture to wetlands and each wetland acre is additionally assumed to treat 2 upland acres of cropland. Using reduction estimates, the above figure equates to \$6.80/lb TN reduced and \$204/lb TP. Assuming that established cost share levels for capital costs from FSA (50%) and the State (37.5%) remain the same as they were in 2003, the farmer will only be responsible for \$17.82/acre/year. After receiving the land rental and maintenance fees and incentives, the farmer pays nothing.

Cost: Estimated Up to \$27,300 annual rental

Estimated Up to \$410,000 installation

Funding: USFW, FSA CREP, Delaware CREP Program, DNREC Wetland Restoration Program

- **CREP Field Border Planting** to trap sediments in surface runoff and take up excess nutrients. This practice could cost as much as \$300/acre for installation depending upon vegetative mix. The cost can be maximized over the 10 year contract to increase long term efficiency. Land is rented for \$65/acre/year and maintained at \$5/acre such that the total expenses equal \$105.17/acre/year. This equates to \$12/lb TN and \$524/lb TP reduced for both best management practices. The installation of these BMPs are cost shared at a total rate of 87.5%, such that the farmer must pay \$4.40/acre/year of the capital costs. Reimbursement for land rental and maintenance could provide virtually zero cost to the farmer.

Cost: Estimated Up to \$1,334,900 annual rental

Estimated Up to \$4,004,700 installation

Funding: FSA CREP, Delaware CREP Program, DNREC Watershed Assessment, and/or NPS Program 319 Funding

- The Team is aware that as of 2007 all lands (over 10 acres) that have nutrients applied must be in compliance with the Nutrient Management Act. The Nutrient Management Act requires all farms over 10 acres or with 8 animal units to establish a nutrient management plan, which includes the use of fertilizers and the fate of manure. Because **Nutrient Management Plans** reduce excess cropland nutrients, the Team strongly recommends that the Nutrient Management Commission ensure full compliance of the Nutrient Management Act. The cost to develop a nutrient management plan decreases as the acreage in the plan increases. A three year plan for an operation with less than 500 acres costs \$5.70, with 501-1,000 acres cost \$4.50, with 1,001-2,000 acres cost \$3.90, and with more than 2,000 acres cost \$3.30 (DNMC, 2004). The average of these values is \$4.35/acre every three years, which when annualized is \$1.45/acre/year. Farmers can be reimbursed the entire cost for developing a nutrient management plan from the Delaware Nutrient Management Commission. The cost can also be expressed as \$0.34/lb TN reduction. At this time, phosphorus reductions are not being calculated for NMPs.

Cost: Estimated Up to \$93,900

Funding: Delaware Nutrient Management Commission, State of Delaware Cost Share, DNREC Watershed Assessment, and/or NPS Program 319 Funding

- **Manure relocation** has removed significant amounts of excess manure from the Inland Bays and Nanticoke watersheds, consequently removing excess nutrients from those watersheds. Thus, the Team recommends that all excess manure (per the Nutrient Management Plan) be removed from the St Jones Watershed. If funds are lacking, the Team recommends that additional state and federal funds be applied to the manure relocation program. The cost per ton of manure relocated is roughly \$13.00/ton. The cost per pound of removing total nitrogen and total phosphorus was thus, \$2.32/lb and \$22/lb, respectively. The Delaware Nutrient Management Commission designs their relocation cost-share program to fully subsidize the cost of the manure transfer, including the clean out so that the farmer bears no cost.

Cost: Estimated Up to \$84,240

Funding: Delaware Nutrient Management Commission, DNREC Watershed Assessment, and/or NPS Program 319 Funding

- Although it is difficult to quantify the nutrient reductions associated with **Structural BMPs** (such as manure structures, pads, sheds and composters) the Team recommends that these BMPs be as fully funded as possible because they insure proper management and storage of manure and dead animals so that they do not become an additional problem for the environment.

Cost: Estimated Up to \$100,000

Funding: NRCS, State of Delaware Cost Share, DNREC Watershed Assessment, and/or NPS Program 319 Funding

AG BMP Current Load Reductions:

	Current (Acres)	Load Reduction Goal TN (lbs/day)	Load Reduction Goal TP (lbs/day)
CRP Practices			
Ponds	3.00	0.11	0.0
Grassed waterways	1.80	0.07	0.0
Grassed filter strips	19.90	0.82	0.01
Wildlife habitat	165.90	6.82	0.09
CREP Practices			
Grass buffers	0.0	0.0	0.0
Grassed filter strips	18.00	1.87	0.04
Forest buffers	0.0	0.0	0.0
Riparian buffers	4.80	0.67	0.01
Wetlands	273.00	38.15	0.82
Field Border (20 ft)--feet	13,349.00	0.27	0.01

Critical area planting	14.30	0.27	0.01
General Ag Practices			
Cover crops	114.00	4.61	0.01
Conservation tillage	1,964.00	0.00	0.01
Manure Relocation	6,480.12 tons	61 lbs/ton	22.4 lbs/ton
Phytase			
Nutrient Management Plans	21,587.63	449.50	15.97
Totals		502.88	16.96

AG BMP Future Load Reductions:

	Goal (Acres)	Load Reduction Goal TN (lbs/day)	Load Reduction Goal TP (lbs/day)
CREP Practices			
Grass buffers/filter strips	1,160.72	11.61	2.32
Forest/Riparian buffers	1,173.92	16.43	3.52
General Ag Practices			
Cover crops	6,132.31	247.81	0.48
Totals		275.85	6.32

b. Other Recommendations for Agriculture

- New funding sources should be sought and financial incentives should be increased for wildlife habitat and wetland restoration.
- The State should partner with the Army Corps of Engineers (and other appropriate parties) to pursue restoration of the St. Jones Watershed.

12) Summary of Outreach & Education Recommendations

a) General Urban Outreach & Education

- An education program for Home Owners Associations should be developed for stormwater BMP maintenance. Educational resources should be provided and ideally, face to face education that stresses the organizations' responsibility. Topics should include: proper use and application of fertilizer and use of salt and sand during periods of snow.

Cost: Estimated 0.3 FTE @ \$10,000

Funding: State General Funds through the Watershed Assessment Section and/or Section 319 Grant.

- The Smartyard Program should be implemented in the watershed to assist homeowners in planting native landscaping to conserve water and reduce fertilizer and pesticide use.

Cost: Estimated \$5,000 annual

Funding: State General Funds through the Watershed Assessment Section and/or Section 319 Grant.

- Corporate environmental stewardship should be encouraged to provide corporations with the technical expertise to help them better manage and enhance their land through the use of native species and the restoration of natural habitat.

Cost: Estimated \$0

Funding: NA

- The Department should coordinate efforts with non profit watershed organizations (e.g., St. Jones Greenway Commission, Silver Lake Commission, etc).

Cost: Estimated \$0

Funding: NA

- A comprehensive education program should be developed for the urban and suburban sector on issues of water quality and urban nutrients. This may include:
 - Working with the University of Delaware to revise soil testing so they are more user friendly.
 - Educating homeowners on the importance of cleaning up pet waste, water conservation, lawn care (and the use of fertilizers) and proper disposal of grass and yard waste.
 - Working with the Delaware Nutrient Management Commission and the Master Gardeners to provide education and programs for homeowners on lawn and garden best management practices.

Cost: Estimated \$0

Funding: NA

b) Stormwater Outreach & Education

- A comprehensive watershed assessment and protection program should be implemented to provide a framework for coordinating multiple watershed protection efforts. This program should promote the integration of local, state and federal water quality improvement efforts and improve public education and participation in all aspects of watershed protection.

Cost: Estimated \$0

Funding: NA

- A comprehensive education plan to teach the public how their actions impact the St. Jones Watershed (and specifically water quality) should be implemented. Some suggestions include:
 1. Public service announcements
 2. Brochures distributed through real estate agents, retailers, and school children
 3. Face to face education with Home Owners Associations and other organizations
 4. Coordination with Master Gardeners' education
 5. Integration of education into the state and local permitting processes
 6. Education on purchasing of water conserving appliances
 7. Education for farmers to recommend appropriate use of buffers on lands in production. (Possibly coordinate with Nutrient Management Commission)

Cost: Estimated 0.3 FTE @ \$10,000

Funding: State General Funds through the Watershed Assessment Section and/or Section 319 Grant.

c) Summary of Agriculture Outreach & Education Recommendations

- Farmers should be educated on the above mentioned BMPs.
- The public should be educated on practices to discourage resident nuisance waterfowl.
- Farm land and natural resource area preservation should be encouraged and promoted. New funding sources should be sought and financial incentives should be increased. The public should receive education on current programs, including:
 - Farmland Preservation Act
 - Kent County Transfer Development Rights
 - Non-profit environmental groups
 - Easements and donations

13) General Recommendations

a) St. Jones Watershed Coordinator

Basis for Recommendation:

The Department reviews this recommendation as a valid and ultimate goal of the Tributary Team process. By hiring a watershed coordinator within the Appoquinimink watershed, much has been

accomplished. The coordinator position has already brought \$265,571.25 into the State of Delaware to improve water quality within the Appoquinimink Watershed. Without these additional funds, many, if not all, of the previously mentioned projects and best management practices would not have been implemented in the fastest growing area of the State of Delaware. In addition, the coordinator has created many new partnerships with groups.

The Silver Lake Commission within the St Jones Watershed has already applied for a grant through the 319 Nonpoint Source Program has already received some indication that this request may be partially funded largely due to success of the Appoquinimink Watershed Coordinator in implementing significant amount of recommendations developed by Appoquinimink Tributary Action Team. The coordinator has been so successful that Region 3 EPA has recognized the actions as a Region 3 success story. The Department hopes that a funding source for this position will be found by the middle of 2008.

Schedule: Hire Coordinator – Feb 2010 (Currently Active)

Outcome: To assess, plan, prioritize, seek funding and implement pollutant reducing BMPs within the St. Jones Watershed.

Stakeholders: State of Delaware DNREC, State of Delaware DOT, Kent County, City of Dover, City of Camden, City of Wyoming, Silver Lake Commission, and the Partnership for the Delaware Estuary.

14) Urban Recommendations

a) Buffers:

Buffers help to filter nutrients and slow overland stormwater flow. Kent County has issued several ordinances related to development and buffers, including an ordinance requiring 100-foot setbacks from blue line streams and tax ditches and a 25-foot buffer/setback for wetlands. However, the County setbacks are not required to be vegetated. Recommendations are being made to strengthen and supplement County and State requirements with the expectation that these measures will protect and improve water quality and the quality of life for the residents in the watershed. Buffers should be required on, but not limited to the following: stormwater and drainage conveyances, grassed waterways, ponds, catch basins, intermittent streams, tidal and freshwater wetlands, and tile wells and based on individual site conditions. In addition buffer should be free of any encumbrances including onsite wastewater treatment and disposal systems.

Watershed Assessment Section conducted an analysis of the stream reaches within the Murderkill Watershed to determine whether the reaches either lack forested riparian buffers, or have only narrow forested riparian buffers were identified using ESRI's ArcGIS software. The analysis included the use of multiple layers of data including 1997 forest cover data from the Delaware Natural Heritage Program, hydrography data from the U.S. Geological Survey (USGS), 2002 wetlands maps from the Delaware Statewide Wetlands Mapping Project (SWMP), and public lands data from DNREC's 2004 Outdoor Resources Inventory (ORI). Since the forest cover data was somewhat outdated, 2002 aerial photos were also used to help update some of the forest cover data as needed.

The GIS software was used to identify 100 foot wide buffer areas around rivers, streams, and tax ditches, and 50 foot buffer areas around freshwater wetlands. Tidal wetland areas were considered unsuitable for the establishment of forested buffers and were removed from the analysis. Tidal portions of the river and any tidal tributaries were included in the analysis. Buffers around tidal areas were considered adequate if the wetlands extended at least 100 feet from the edge of the water. For all non-tidal areas, buffers were considered adequate if the entire designated buffer areas consisted of forests. Stream sections within the watershed were categorized into three groups according to the status of the adjacent forested riparian buffers. The three categories included: 1) adequate forested buffers along both stream banks, 2) deficient forested buffers along either one or both stream banks, or 3) no forested buffers along either stream bank. Since the establishment of additional forested riparian buffers has a greater likelihood of being implemented on public lands than on privately owned lands the analysis was broken out for both publicly owned and private lands.

A similar analysis could be conducted within the St Jones watershed to develop a buffer overlay map which would be developed in cooperation with local municipalities and used to coordinate efforts among jurisdictions.

Schedule:

GIS Analysis	July 2010
Workshops	December 2011
Meet with Local Jurisdictions	June 2011

Outcome: Strengthen and supplement County and State requirements with the expectation that these measures will protect and improve water quality and the quality of life for the residents in the St. Jones Watershed. Buffers should be required on, but not limited to the following:

- stormwater and drainage conveyances,
- grassed waterways,
- ponds, catch basins,
- intermittent streams,
- tidal and freshwater wetlands,
- tile wells and
- other area based on individual site conditions.

Stakeholders: State of Delaware DNREC, State of Delaware DOT, Kent County, City of Dover, City of Camden, City of Wyoming, Silver Lake Commission, and the Partnership for the Delaware Estuary.

b) Public Lands Open Space Management

Land maintained as passive or active open space under local ordinances or codes should be managed to minimize nutrient loading.

Basis of Recommendation: Open space can have many valuable functions and should include natural areas; however, wetland restoration areas and buffers should be included as open space. Open space should be developed with appropriate native vegetation and protected through easements. In impaired watersheds, it makes sense that water quality protection should be

important when developers design open space. Maintenance of these spaces is important for water quality benefits. It is logical that inclusion of open space in a developed area will help to reduce nutrient loads; it is difficult to assign a specific load reduction to this recommendation. Kent County Conservation District has initiated assessing all stormwater BMPs installed in Kent County, identifying priority areas for stormwater retrofits and evaluating the effectiveness of BMPs already constructed.

Since 2000, DelDOT has actively managed the State's road sides for habitat and environmental quality. Although safety and efficiency of the road system is paramount with DELDOT, the quality and character of highway vegetation contributes greatly to the pleasure of the overall experience. In addition to making automobile travel more enjoyable, DELDOT believes that well-managed highway vegetation contributes to regional pride of place and plays a strong supporting role in tourism and local economic development. When sound horticultural and ecological principles are brought to bear on vegetation management, roadside rights-of-way also serve as regional nature preserves, maximizing biodiversity while minimizing routine maintenance requirements.

DELDOT believes that planning for roadside landscapes must be an integral part of all road design projects and must begin with the initial phases of design. Early consideration of roadside landscape design maximizes opportunities for cost efficient, attractive and sustainable solutions that are sympathetic to roadway engineering and maintenance. To this end DelDOT developed a planning manual (*Enhancing Delaware Highways*) which resulted from a collaborative research process between the DelDOT the Delaware Center for Horticulture (DCH) and the University of Delaware (UD). This *Enhancing Delaware Highways* manual presents approaches to the planning, design, installation and maintenance of roadside landscaping. It offers ideas, concepts and schemes to guide designers and administrators in their everyday decisions.

The contents of *Enhancing Delaware Highways* are intended to fully integrate functionality and beauty of Delaware's transportation corridors through planning, design, development, maintenance and administration of quality roadside design concepts.

Schedule:

Assessment of DelDOT Activity	July 2010
Review DelDOT Current Policy	July 2010
Workshops	December 2011
Design and Review	On Going

Outcome: The principal objectives are to:

- document DelDOT policies with respect to roadside plantings and vegetation modifications,
- define criteria necessary to guide judgments and decisions in the roadside design process,
- set forth the most current and effective roadside landscape design techniques and procedures, and
- assure that safety, economic, aesthetic and environmental quality factors are adequately considered in the design process.

Stakeholders: State of Delaware DNREC, State of Delaware DOT, Kent County, City of Dover, City of Camden, City of Wyoming, Silver Lake Commission, and the Partnership for the Delaware Estuary.

c) Private Land Open Space Management

Home Owners' Association members should be educated on caring for open space in their neighborhoods to minimize nutrient loading and encourage natural habitat.

Basis of Recommendation: Based on 2002 land use data, a significant portion of St Jones Watershed is urban (27 percent) and much of it is turf. Over 73,000 acres of residential turf exists in Delaware and 58 percent of it is fertilized, usually with little forethought. The St Jones Tributary Action Team has identified residential activities as an important origin for nutrients in the St Jones Watershed and thus has made several recommendations to address this issue. Residential behavior is a difficult source to regulate, thus the Team's recommendations focus on providing education and outreach activities to change residential behavior and increase environmental awareness.

DNREC's Sediment and Stormwater program developed and completed a handbook for homeowners associations that can be used to learn how to maintain their stormwater plan. DNREC, as well as the agencies with delegated authority from the Sediment and Stormwater program, are working with homeowners in forwarding this concept. The Kent and Sussex County Conservation Districts with cooperation from DNREC's Sediment and Stormwater Program and NEMO has held workshops for homeowners associations and residents in Kent and Sussex Counties.

A comprehensive education plan to teach the public how their actions impact the St. Jones Watershed (and specifically water quality) should be implemented. Some suggestions include:

- A. Public service announcements
- B. Brochures distributed through real estate agents, retailers, and school children
- C. Face to face education with Home Owners Associations and other organizations
- D. Coordination with Master Gardeners' education
- E. Integration of education into the state and local permitting processes
- F. Education on purchasing of water conserving appliances
- G. Education of school children on water quality

Schedule:

PSAs	January 2011
Brochure Development	January 2011
Workshops	December 2010
Follow Up, Review and Assessment	On Going

Outcome: Improved management of residential turf within the St. Jones Watershed.

Stakeholders: State of Delaware DNREC, State of Delaware DOT, Kent County, City of Dover, City of Camden, City of Wyoming, Silver Lake Commission, Delaware Nature Society, and the Partnership for the Delaware Estuary.

d) Home Owner Education Strategy:

Since Home Owners Associations are critical for successful stormwater BMP maintenance, there should be a governmental agency charged with making sure the Associations are functional. In the Association by-laws, there should be a requirement for stormwater education. An education program for Home Owners Associations should be developed for stormwater BMP maintenance. Educational resources should be provided and ideally, face to face education that stresses the organizations' responsibility. Topics should include: proper use and application of fertilizer and use of salt and sand during periods of snow. The Smartyard Program should be implemented in the watershed to assist homeowners in planting native landscaping to conserve water and reduce fertilizer and pesticide use.

Examples of BMPs/Projects:

- Smartyards
- Rain Garden Demonstrations
- Pet Waste Management

Basis of Recommendation: The plan should:

1. Identify values which are affecting residential activities and target those that will effect behavior change
2. Encourage educational facilities with turf athletic facilities where nutrients are applied to develop nutrient management plan for their facility. (The DNMA requires licenses for facilities personnel applying nutrient fertilizers to educational facility.)
3. Develop an advertising strategy that promotes the use of soil tests to the urban/suburban homeowner.
4. Work the University of Delaware to revise their soil test results sheet for homeowners to make it easier to be understood and provide specific fertilizer application recommendations based upon existing fertilizer blends found within the State.
5. Education of fertilizer retailers such that retailers will pass out educational materials with purchase of fertilizer and will have available soil testing materials at their location
6. Educate homeowners and homeowner associations on stormwater BMPs that can be used around the home to reduce impact on water quality
7. Integrate education into various (State and local) permitting processes and public information campaigns should be based upon goal of behavior change
8. Support a demonstration project/workshop for homeowners on application of fertilizers and composting methods.
9. Support and encourage the use of water conservation measures by individuals to help reduce the amount of nutrients leaving individual properties. Use of these measures will help in the effort to reduce the amount of nutrients ending up in the Murderkill River.
 - Gray water recycling (use of gray water around the home on plants and gardens, etc),
 - Rain collection systems such as rain barrels and rain gardens,

- Directing stormwater runoff from roofs and impervious surfaces onto grassy areas,
 - The use of water saving devices in and around the home, in addition to
 - The overall reduction of water usage in households and on lawns
10. Work with the Delaware Nutrient Management Commission and the Master Gardeners to provide education and programs for homeowner's on lawn and garden best management practices such as:
- Proper mowing practices,
 - Leaving lawn clippings on the lawn;
 - Encourage proper lawn care maintenance-leave a buffer along stream edge;
 - Reduce lawn size;
 - Water conservation measures and stormwater BMPs for the lawn and garden;
 - Encourage use of native species and noninvasive species;
 - Discourage ideas that lawns need chemicals to be green;
 - Proper use of lawn and garden chemicals (including natural fertilizers and compost);
 - Use of compost rather than chemicals as a means of reducing synthetic chemical fertilizers.

Nutrient contributions from lawn care are assumed to be high, however it is very difficult to quantify. In Delaware, 58 percent of homeowner turf acres were fertilized¹. Of these the average nitrogen application rate to home-lawns falls within the range recommended by the University of Delaware Soil Test Procedure (UDSTP) and phosphorus application rates fall below the range specified by UDSTP. Also in this study, researchers found that professional landscape services used significantly less fertilizer than homeowners.

Schedule:

PSAs	January 2011
Brochure Development	January 2011
Workshops	December 2010
Follow Up, Review and Assessment	On Going

Outcome: Improved management of residential turf within the St. Jones Watershed.

Stakeholders: State of Delaware DNREC, State of Delaware DOT, Kent County, City of Dover, City of Camden, City of Wyoming, Silver Lake Commission, Delaware Nature Society, and the Partnership for the Delaware Estuary.

e) Stormwater Utility

A stormwater utility should be explored to generate a stable source of funding for stormwater management within the watershed.

Basis of Recommendation: Stormwater best management practices have maintenance requirements and operational expenses. Most community management associations do not have

the knowledge or the financial means to operate and manage their stormwater structures. The Sediment and Stormwater regulations serve as an enabling structure for the local ordinances needed in order to set up the utility. The Sediment and Stormwater program has held several workshops to generate interest in the formation of a utility. Stormwater utilities are designed to become a funding mechanism for stormwater retrofits and maintenance.

Schedule:

Workshops	December 2011
Meet with Local Jurisdictions	June 2011

Outcome: Strengthen and supplement County and State ability to generate a stable source of funding for stormwater management within the St. Jones Watershed

Stakeholders: State of Delaware DNREC, State of Delaware DOT, Kent County, the City of Dover, the City of Camden, and the City of Wyoming.

f) Stormwater Best Management Practices

Stormwater BMPs should be designed to reduce nutrients according to TMDLs.

Basis of Recommendation: Since 1991, stormwater runoff from new development is regulated under the Delaware Sediment & Stormwater Regulations, administered by the Division of Soil & Water Conservation. As stormwater moves over land, it picks up natural and human-made pollutants from lawns, streets, parking lots and industrial and commercial facilities, eventually depositing them into the waters of the Murderkill. Stormwater management is the primary way to control nonpoint source pollution from developed areas. A variety of methods can be used to control and treat runoff from lawns, homes, parking lots, roads and commercial and industrial facilities. Some of these methods reduce nutrient loading from stormwater more than others. When possible, these methods should be preferred. However, there may be instances where the pollutant of most concern on the site would not be reduced sufficiently by the most effective nutrient removal technique. In these cases, the method used should be the best at treating the removal of the pollutant of most concern. Reducing stormwater impacts within the St. Jones will require action by all stakeholders and will require innovative management techniques.

A result of the Pollution Control Strategy (PCS) for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay Watersheds, several options were developed to control nutrient loadings in stormwater runoff from new development. These are generally divided into two categories: Performance-Based approaches and Standards-Based approaches. The Performance-Based approaches, as defined in Sections 5.3.1-5.3.3 of the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay PCS Regulation, require that the designer perform calculations to verify that the nutrient reduction goals for a given project have been satisfied. The first goal should always be to apply Green Technology BMPs in accordance with the Delaware Sediment & Stormwater Regulations. These BMPs are intended to recharge stormwater runoff and decrease pollutant loadings accordingly. A series of calculations based on the proposed BMP selection is then performed to determine whether the pollutant loadings have been reduced enough to meet target levels as defined in the PCS. The process also recognizes the concept of the “irreducible concentration.” That is, the current technology is only capable of

reducing pollutant concentrations to a certain level. Once that level is reached, it is considered to have met the current Best Available Technology (BAT). If the irreducible concentration has not been met, the designer must employ a “treatment train” approach by adding BMPs in series and going through an iterative process to determine whether the required reductions have been met or the irreducible concentration has been reached. This iterative process continues up to a maximum of three (3) BMPs, which is also considered BAT for the purposes of those Regulations. The Standards-Based approaches are contained in Sections 5.3.4 and 5.3.5 of the PCS Regulation. These approaches are based on preserving specific natural features of a site and preclude having to perform load reduction calculations to verify compliance.

Schedule:

Workshops	December 2011
Meet with Local Jurisdictions	June 2011

Outcome: To encourage the use of Stormwater BMPs that best serve at treating the removal of the pollutant(s) of most concern thereby reducing stormwater impacts within the St. Jones Watershed.

Stakeholders: State of Delaware DNREC, State of Delaware DOT, Kent County, and the Kent County Conservation District.

g) Stormwater Inventory

A stormwater inventory should be conducted to identify areas where stormwater retrofits would effectively reduce sediment and nutrients.

Basis for Recommendation: Land developed prior to 1990 did not have any stormwater requirements. Kent County Conservation District has delegated authority from DNREC to run the stormwater program in Kent County and is in the process of identifying priority areas for stormwater retrofits.

Department of Natural Resources and Environmental Control (DNREC) has hired Duffield Associates, Inc. to develop a Watershed Implementation Plans for the St. Jones River and the Broadkill River. The purpose of the plan is to characterize the watershed quality, identify potential sources/types/location of impairment, and to identify potential restoration opportunities. The focus of these watershed plans is water quality and associated natural resources. A focus of the study is to identify potential restoration opportunities in the watershed. Restoration/enhancement/preservation opportunities will be identified in the following major categories:

- Stream/Riparian Buffers/Floodplains;
- Wetlands;
- Agricultural Best Management Practices;
- Urban Stormwater Retrofits;
- Urban Sub-watershed Site Reconnaissance; and
- Conservation easements or acquisitions.

Schedule:

Characterization of Watershed	August 2008
Develop Stormwater Priority	November 2008
Workshops	December 2010
Meet with Local Jurisdictions	June 2011

Outcome: Identification and prioritization of potential restoration/preservation/improvement projects within the St. Jones Watersheds for implementation by DNREC and others.

Stakeholders: State of Delaware DNREC and the Kent Conservation District

15) Agriculture Recommendations

a) Agriculture Best Management Practices:

Best Management Practices (BMPs) for agriculture should be encouraged and supported. New funding sources should be sought and financial incentives should be increased. The following BMPs, in particular, should be considered for additional funding:

- A. **Cover crops** to protect soil when row crops are not being grown. This practice helps retain nitrogen in the soil for the next crop which reduces fertilizer costs to the farmer.
- B. **Grassed filter strips and grassed buffers** to trap sediments in surface runoff and take up excess nutrients.
- C. **Grassed waterways** to transport surface runoff away from cropland without causing erosion or flooding and protect and improve water quality.
- D. **Riparian forested buffers** to reduce nutrient losses from upland acres and to reduce sediment bound phosphorous from entering waterways.
- E. **Water control structures** to increase the water level in the field which allows for denitrification and reduces dependency on irrigation.
- F. **Pasture stream fencing** to reduce the bacterial and nutrient loads to a water body.

Basis of Recommendation: The establishment of best management practices on agricultural land will address nutrient inputs from all facets of agriculture operations, including the use of manure from animal operations and fertilizers for crops. Voluntary use should be recommended first. Identify areas where BMPs can be implemented. The environmental and quality of life benefits of agriculture should be recognized as a way to encourage and enforce BMP implementation. Encourage use of buffers on agricultural lands where best nitrogen and phosphorous uptake is likely. By targeting areas for BMP implementation geographically, more effective and efficient nutrient reductions can likely be expected.

The Kent Conservation District developed a Geographic Information System database of farm fields to improve their ability to coordinate and effectively manage agricultural NPS pollutant reductions. The spatial database will facilitate a more efficient:

- Consolidation of information from the numerous agricultural agencies that develop and

- administer BMP and conservation practices;
- Approach to highlighting the geographic location of all existing BMP and conservation practice locations in a designated watershed; and
- Utilization of watershed planning tools capable of targeting and ranking farm field properties for various BMP and conservation practice implementation.

This Geographic Information System database tool was developed to identify and target farm field sites for potential enrollment in various state and federal agricultural voluntary cost-share programs that address nutrient nonpoint source pollutant loading. This tool will allow the District and its state and federal partner agencies to maximize the limited implementation funds and planning resources earmarked for potential agricultural NPS loading sources within the St Jones Watershed.

The farm field GIS database was utilized to conduct a desktop assessment of potential nutrient loading sources and to assist with the future prioritization of agricultural BMP and conservation practice implementation in the specified subwatershed areas of the St Jones River. Agricultural BMP and conservation practices addressing three nutrient loading pathways were reviewed: Nutrient (nitrogen) loading from cropland in high groundwater recharge areas; nutrient (nitrogen and particulate phosphorous) loading into stream areas lacking appropriate riparian buffering; and nutrient (nitrogen and phosphorous) loading from farm animal waste sources. A number of farm fields were prioritized for potential voluntary enrollment in the existing state and federal agricultural cost-share programs. This prioritization provides the District and their state and federal agency partners with an ability to initiate a proactive approach to farm field enrollment in available agricultural BMP and conservation practice cost-share programs.

EXPECTED Schedule:

Characterization of Watershed	August 2004
Ag Tool Development	November 2004
Develop Agriculture Priority Plan	November 2008
Cost Share Sign Up	Continuous
BMP Implementation	Continuous
BMP Inspection and Review	Continuous

Outcome: Identification and prioritization of potential farm field sites and agriculture operations for potential enrollment in various state and federal agricultural voluntary cost-share programs that address nutrient nonpoint source pollutant loading.

Stakeholders: State of Delaware DNREC, State of Delaware Department of Agriculture, the Kent Conservation District, NRCS, FSA, Delaware Poultry Growers Incorporated, the Delaware Farm Bureau, and the Kent County Farm Bureau.

b) Nutrient Management:

The Team is aware that as of 2007 all lands (over 10 acres) that have nutrients applied must be in compliance with the Nutrient Management Act. The Nutrient Management Act requires all farms over 10 acres or with 8 animal units to establish a nutrient management plan, which includes the use of fertilizers and the fate of manure. Because **Nutrient Management Plans** reduce excess

cropland nutrients, the Team strongly recommends that the Nutrient Management Commission ensure full compliance of the Nutrient Management Act.

Basis for Recommendation: Basis of Recommendation: As of 2007 all lands (over 10 acres) that have nutrients applied must be in compliance with Nutrient Management Act. The Nutrient Management Act requires all farms over 10 acres or with 8 animal units to establish a nutrient management plan, which includes the use of fertilizers and the fate of manure. Assessing the impact of this requirement will quantify the efficiency and reduction of nitrogen and phosphorus.

Since the baseline period (1997), the agriculture community has reduced a significant amount of nonpoint source nutrient loading, leading the efforts to curtail nonpoint source nutrient loading. From the 1997 to 2003, multiple Best Management Practices (BMPs) have been implemented, and the Delaware Nutrient Management Act was passed. As of February 2003, 6,116 acres of cropland already has had nutrient management plans developed and by 2007 all farms that apply nutrients to ten acres or more will be required to have Nutrient Management Plans (NMPs). The 2002 Farm Bill has led to unprecedented funding levels of cost-share programs for BMPs that protect the environment, especially water quality.

In many watersheds polluted runoff from cropland, manure-disposal sites, and concentrated animal-feeding operations (CAFOs) are some of the important sources of phosphorus to surface waters. As of 2002, there were 29 poultry operations, which produce approximately 2,490,684 birds annually, 2 dairies, 8 beef cattle operations, 13 equine and 4 goat operations in the Murderkill Watershed. Potential nutrient inputs are related to manure, runoff, erosion, and atmospheric deposition of nutrients. In 2002, 55% of the Murderkill Watershed was used for agriculture, which equates to approximately 37,393 acres. In 1997, agricultural land use accounted for 58% of the total land area in the watershed; therefore, the agricultural activity is the second leading source, after the Kent County treatment plant, of phosphorus entering the waterways. In addition, these sources contribute a significant loading of nonpoint source nitrogen.

There are 35,849 acres of crops in the watershed. Crops require nutrients in order to produce an economic yield. Crops produced in the watershed may include soybeans, potatoes, barley, wheat, corn, and vegetables. Nutrient inputs include fertilizer and manure application, which if applied improperly may contribute to nutrient over-enrichment in streams and tributaries in the St. Jones Watershed.

Delaware's Nutrient Management Act was passed in 1999. This Act requires anyone who applies nutrients to 10 acres or more or anyone who manages eight or more animal units within the state to create and submit a nutrient management plan (NMP) to the Nutrient Management Commission. Implementation was phased over a five year period with 20% of those applicable submitting applications each year starting in 2003. By 2002, 20% of the farmers within the state have complied with Act and of January 1, 2007, 100% implementation has been achieved. Assessment of this Act quantifies the effectiveness of planning on the reduction of nitrogen and phosphorus in TMDL watersheds.

EXPECTED Schedule:

Delaware Nutrient Management Law	August 1999
Nutrient Management Reporting	Continuous/Annually
CAFO Law Adoption	November 2010
CAFO Inspection and Review	Continuous

Outcome: All farms over 10 acres or with 8 animal units will establish a nutrient management plan, which includes the use of fertilizers and the fate of manure.

Stakeholders: State of Delaware DNREC, State of Delaware Department of Agriculture, the Kent Conservation District, NRCS, FSA, Delaware Poultry Growers Incorporated, the Delaware Farm Bureau, and the Kent County Farm Bureau .

16) Implementation Strategy

a) Time Line and Schedule for Funding

	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15
Salary for Implementation Coordinator for St Jones River		30,000	\$35,000	\$40,000	\$35,000	\$35,000	\$35,000	\$35,000
Conservation Planners	\$112,295	\$112,295	\$112,295	\$112,295	\$112,295	\$112,295	\$112,295	\$112,295
CREP Coordinator	\$69,000	\$69,000	\$69,000	\$69,000	\$69,000	\$69,000	\$69,000	\$69,000
Buffer Project for Silver Lake	\$80,000	\$35,000						
Stormwater Implementation Plan	165,000							
Pet Waste Collection Project		\$5,000						
Rain Gardens	\$25,000							
Smartyards		\$5,000	\$5,000	\$5,000				
Stormwater Retrofit and Stream Restoration		\$50,000	\$50,000	\$50,000				

17) Interim Water Quality Milestones

a) Defined Milestones

Do in large part to Delaware's Geology and the significant ground water driven water recharge cycle found in the St. Jones River Watershed, BMP implementation will not result in immediate improvements of water quality data. However, there are indicators that water quality is improving. For example, through modeling, estimates of load reductions can be made that demonstrate pollutants are removed from the water systems as a whole. For the St. Jones River Watershed, the following BMP implementation milestones will be tracked to demonstrate achievement of Interim Water Quality Milestones:

BMP	1 year Goal	Interim Milestone	2 Year Goal	Interim Milestone	5 Year Goal	Interim Milestone
Urban Buffers	100 acres	100 X 0.57 lbs N/day = 57	200 acres	200 X 0.57 lbs N/day = 114	500 acres	500 X 0.57 N/day = 285
Septic Pump-Outs	650 units annually	650 X 0.004 lbs N/day = 2.6	1,300 units annually	1,300 X 0.004 lbs N/day = 5.2	3,287 units annually	3,287 X 0.004 lbs N/day = 13
Ag Forest Buffers (acres)	232 acres	232 X 0.01 lbs N/day = 2.32	464 acres	464 X 0.01 lbs N/day = 4.64	1,161	1,161 X 0.01 lbs N/day = 11.16
Ag Grassed Buffers (acres)	234 acres	234 X 0.014 lbs N/day = 3.28	468 acres	468 X 0.014 lbs N/day = 6.56	1,174	1,174 X 0.014 lbs N/day = 16.4
Annual Cover Crop (acres)	1,226 acres	1,226 X 4.61 lbs N/day = 5,652	2,453 acres	2,453 X 4.61 lbs N/day = 11,304	6,132 acres	6,132 X 4.61 lbs N/day = 28,259

b) Monitoring Milestones

The following are Milestones are hoped to be achieve during the St. Jones Watershed Implementation Plan process:

- If 45% of the agricultural BMP's in this plan are implemented, a reduction of nitrogen and phosphorous loads in the St. Jones watershed will be reduced by 25%. This milestone should take approximately 12 years (+/- 2-3 years) to achieve.

- If 30% of the riparian buffers in this plan are implemented, a 20% increase in intolerant macroinvertebrate species in the streams could be realized. This milestone should take approximately 8 years (+/- 1-2years) to achieve.
- If 20% of the urban BMP's practices in this plan are implemented, a 1-2 degree decreases in water temperatures in the streams. This milestone should take approximately 6 years (+/- 2- 3 years) to achieve. (This milestone assumes new development will reduce or sustain current stormwater flows and that current urban BMP projects can be retrofitted to alleviate stormwater issues.)

c) Milestone Tracking

Implementation progress of possible strategies identified above will be reviewed annually through the Delaware NPS Program Annual Report development process. Through the Delaware NPS Program Annual Report, progress will be reported and if Delaware is falling short on implementing key actions within the St. Jones River Watershed, it will pursue contingencies. Delaware has a detailed tracking system that identifies locations and activities within Delaware's watersheds at a 14 digit HUC Code scale.

As identified above, the BMP milestones identified for tracking within the St. Jones River Watershed include urban buffers, septic pump-outs, ag buffers, and cover crop. Each BMP milestone goal will be assessed identifying the number of units implemented cumulatively and the associated load reduction achieved. Based on the load reduction goal and actual implementation for that BMP milestone a percentage of the goal achieved will be calculated annually. If a BMP milestone is considerably behind, the Delaware NPS Program will analyze why and determine if a contingency is warranted. A contingency may not be warranted if the implementation or funding schedules are on track. A similar BMP milestone approach is applied to the TMDL implementation tracking and reporting as managed under DNREC's Watershed Assessment Program to determine if contingencies are needed.

d) Milestone Gaps

Since most of the BMPs are targeted on lands within the St. Jones River Watershed that are agriculture, there is a need to increase BMPs on these lands, and therefore, there is a need to increase the funding sources for BMP programs. Various alternatives to filling this funding gap should be considered. Realizing a significant boost in funding will be warranted for full BMP implementation, it is imperative Delaware pursue increased funding through State programs such as the State of Delaware Conservation Cost Share, Delaware CREP, Delaware Nutrient Relocation, Delaware CAFO, and Delaware Nutrient Management Programs. Likewise, it is essential Federal Programs, such as EQIP be expanded or re-prioritized within the St. Jones River Watershed to account for additional funding needs. Delaware is committed to working closely with NRCS, FSA, and EPA to assure additional Federal resources will be available to accommodate the BMP recommendations made within the contents of this document. As additional funding needs will certainly be warranted, private grants and/or exploratory grants should be additionally pursued. Lastly, to accommodate easier land owner participation by Private Landowners, the State of Delaware, Revolving Loan Fund should be review and expanded to allow additional BMP funding as applicable.

18) Agriculture Implementation Strategy – Project Proposals

The following project proposals represent recent NPS Program Grant submittals that can target the above referenced BMPs.

A. Kent County Conservation Planners

Introduction

Conservation planning is direct, one-on-one contact with agricultural producers. The purpose is to assess various natural resource concerns or issues on the farm, and to assist the agricultural operator with technical expertise and financial incentive programs (state, federal and local) in order to fully implement a comprehensive resource conservation plan.

Technical Assistance

Conservation Planning and Follow-Up on Implementation: Upon request, or as deemed necessary, nutrient management certified planners will establish and implement comprehensive resource phosphorus based conservation plans on 2,500 acres per year in areas where none currently exist. All nutrient management planning will meet the NRCS Nutrient Management Planning Standards (Code 590). These plans will cover a broad spectrum of areas including conservation tillage, integrated pest management, nutrient management, and a host of other water quality practices and programs. Plans will be developed and implemented in compliance with USDA NRCS standards and specifications. Follow-up on these conservation plans will be conducted semi-annually or more frequently as needed to promote full implementation of the comprehensive resource conservation plan. Planners will complete a monthly workload analysis which will be submitted to the NPS Program on a quarterly basis. All comprehensive conservation plans are to be entered into a GIS system. Information will be provided quarterly to the NPS program.

Nutrient Management Compliance Assistance: Upon request, the planners will assist Cooperators with the details of the State of Delaware's Nutrient Management Regulations to ensure compliance. Requests often come directly from the Cooperator or directly from the Delaware Department of Agriculture's Nutrient Management Program.

Rural Landowner Assistance: Upon request, they will work with the University of Delaware's Cooperative Extension Office to educate and assist new rural landowners on how to best manage their new properties. The Planners efforts will be focused on issues affecting water quality.

Financial Assistance

Conservation Cost-Share: The planners will work with farmers to secure financial assistance to implement water quality best management practices (BMPs) from various local, state, and federal agencies. Annually, the Conservation Districts receive funds to assist farmers in installing a host of BMPs, including cover crops, poultry manure structures, poultry carcass composters, grassed waterways, water control structures, wildlife habitat, etc. Assistance will include providing information and necessary documentation for implementation.

State Revolving Fund (SRF): The planners will inform farmers about the Agricultural Nonpoint Source SRF Program which offers a low-interest loan to construct certain water quality best management practices (BMPs). SRF can be used separately or in conjunction with conservation cost-share, and applies to poultry and dairy operations.

Environmental Quality Incentives Program (EQIP): Part of the 1996 Farm Bill, this U.S. Department of Agriculture program is one of the most successful conservation programs yet, at the federal level. The planners funded under this grant, in conjunction with the Natural Resources Conservation Service, will implement structural and management BMPs available through the EQIP program.

Outputs and Outcomes

Under this proposal, funding will be provided to KCD for three Conservation Planners to accomplish the following goals:

1. Draft Nutrient Management Plans – 8,000 acres
2. Encourage planting of Cover Crops – 12,000 acres
3. Encourage the use of Pre-Sidedress Nitrogen Testing – 8,000 acres
4. Encourage the installation of Dairy Manure Storage Systems – 1
5. Encourage the installation of Poultry Manure Storage Structures – 8
6. Encourage the installation of Poultry Composters – 6
7. Encourage the installation of Heavy Use Protection Areas - 50
8. Encourage the installation of Horse Manure Storage Structures - 2
9. Encourage the purchase and use of Dairy Manure Spreaders – 1
10. Encourage the purchase and use of Poultry Manure Spreaders – 5
11. Encourage the purchase and use of Front End Loaders – 10

The estimates above are based on past performance and program participation. Funding for the implantation of BMPs can be drawn from varying sources (e.g. NRCS EQIP, State of Delaware Cost Share, and/or CWA Section 319). The hired Conservation Planners assist land owners who participate in the various cost share programs, prepare nutrient management plans, oversee the implementation/construction of agriculture related BMPs, and conducted extensive outreach and education related to agriculture conservation practices.

Operation and Maintenance Plans are signed by the participation landowner and are effective upon receipt of cost share funding for BMP implementation. The Conservation Planners will conduct yearly follow-up on implemented BMPs and the conservation and nutrient management plans.

Past Activity (2009)

In 2009, two Conservation Planners operating at the Kent County Conservation District were funded through a Section 319 Nonpoint Source Pollution grant and through base funding with the state of Delaware. The Conservation Planners work with the farming community providing nutrient management planning, cost-share funding for agricultural best management practices,

and partnering with the USDA's Natural Resources Conservation Service in developing conservation plans and Environmental Quality Incentive Program (EQIP) contracts.

Much of the districts' effectiveness is due to their ability to work with local, state, and federal agencies to solve local environmental problems. KCD enters into agreements (memorandums of understanding) with cooperating agencies and organizations that outline the obligations of each party and the assistance available. KCD operations are supported by federal, state and local governments and private individuals. The USDA Natural Resources Conservation Service (NRCS) and the Delaware Department of Natural Resources and Environmental Control (DNREC) provide technical leadership to KCD. Additional cooperating agencies include: the University of Delaware's Cooperative Extension Service, the USDA Farm Service Agency, the Delaware Department of Agriculture (DDA), and the First State Resource Conservation and Development Council.

KCD receives an annual allocation from the State of Delaware administered through DNREC, which is used to cost-share with landowners for environmentally sound improvements of their land. This funding also provides a portion for personnel and administrative costs to run the program. KCD also receives funding from the state and county government to address the needs of the tax ditch systems within Kent County. Additional funding is received through special conservation grants and equipment rental.

Employees within KCD provide technical, administrative, and clerical support to district programs. At times, Earth Team Volunteers assist with carrying out the District's conservation programs. KCD works directly with farmers, landowners, and municipalities on the following types of challenges: water quality protection; stormwater management; aquifer protection; land use planning; erosion and sediment control on land undergoing development, farmland, critical areas and public lands; flooding problems; wetlands protection; soil survey information; and sustainable agriculture.

2009 Highlights:

The State of Delaware General Assembly provided \$400,000 in cost share funds, which were utilized by different cooperating landowners. Projects implemented emphasized water quality, water management, and erosion/sediment control. Funds were allocated for the practices below:

BMP	Number	Unit
Poultry Heavy Use Area Protection	51	Pads
Poultry Manure Structures	3	Each
Dead Bird Composters	3	Each
Manure Spreaders	4	Each
Front-end Loaders	2	Each
Cover Crops	12,058.9	Acres
Tile Drainage	757	Feet
Ditch Dipout	14,308	Feet
Rentar	4	Each
Roof Run Off System	1	Each
Dairy Ag Waste Roof System	1	Each

The Conservationist Planners completed a total of 354 inspections of installed practices (excluding drainage, which is every other year) to ensure the practices are working properly and do not need any maintenance.

The total amount of EQIP cost-share funds earned for 2009 was \$1,327,401. This money was used for the implementation of the water quality practices listed below:

BMP	Number	Unit
Composters	5	Each
Fencing	10,625	Feet
Heavy Use Area Protection	62	Pads
Irrigation Sprinkler Systems	513	Each
Nutrient Management	934	Acres
Pasture and Hay Planting	10	Acres
Pest Management	1,540	Acres
Waste Storage Facilities	5	Each
Windbreak / Shelterbelt	4,685	Feet

In 2009, KCD, in cooperation with the University of Delaware Cooperative Extension Service, continued to provide pre-side dress soil nitrate tests (PSNT) to all interested corn growers in Kent County. Use of this test can result in economic savings and reduce the chance of groundwater contamination by nitrates. In 2009, a total of 163 samples were tested covering 6,796.95 acres. The District's conservationists also worked with cooperators in testing manure as well. Last year the following numbers of manure samples were tested: dairy - 6; poultry - 18; horse - 4; and beef - 3. The conservationists also completed 34 animal waste plans and 19 nutrient management plans covering 5,098.1 acres.

B. CREP Coordinator

Introduction

USDA's Farm Service Agency (FSA), Natural Resources Conservation Service (NRCS), and the State of Delaware have agreed to implement a voluntary Conservation Reserve Enhancement Program (CREP) to improve water quality and increase wildlife habitat.

The Delaware Nonpoint Source Program with partnership support of FSA and NRCS, requests the support of funding for a contractual employee position to coordinate Delaware's CREP effort. The full time position is tasked with marketing, managing, and coordinating of all aspects of the CREP implementation program.

The CREP designated project area includes Coastal Plain sites in the Chesapeake, Delaware, and Inland Bays watersheds.

Eligible Practices and Program Targets:

Statewide, the Delaware State Conservation Reserve Enhancement Program is authorized to enroll up to 6,000 acres devoted to the following CREP practices and acres:

CP3A (Hardwood Trees) – 500 acres,
CP4D (Wildlife Habitat) – 1,000 acres,
CP21 (Grassed Filter Strips) – 3,000 acres,
CP22 (Riparian Buffers) – 1,000 acres, and
CP23 (Wetland Restoration) – 500 acres.

Currently, placement of practices must adjoin impaired streams or contributing drainage ditches in the designated project area.

Program Goals

The overall outcome goal of this project is to improve water quality in Kent and Sussex County watersheds. Installation of the eligible CREP practices will assist in meeting the following improvement goals:

1. Reduce nutrient and sediment loading to impaired streams, and
2. Meet temperature and dissolved oxygen criteria necessary to support biology and wildlife, and
3. Increase upland wildlife habitat and create wildlife corridors.

Delaware has multiple programs providing financial assistance, but does not support technical assistance. Delaware's Nonpoint Source program is partnering with FSA and NRCS by providing dollars for marketing and implementing CREP (Dale Churchey). The primary emphasis of project activities will be on the coordination of CREP implementation and planning priorities. This will include, but is not limited to the following:

- Participate in outreach, education and marketing events to promote CREP;
- Assist in the financial analysis of rental and planning rates;
- Assist in the prioritization CREP Projects; and
- Maintain the project location information and planning efforts on a watershed-based scale.

Funds will be used in the support of a full time staff position to assist in Delaware CREP to ensure success of the program.

19) Program Monitoring

a) Kent Conservation Planners

Measures of success will be tracked at the 12 digit HUC code using Access and ArcView GIS, and will include the following:

1. Percent compliance – planners will define % compliance of each farm. An operation can receive a maximum compliance percentage of 60% for full BMP (Structural) implementation and 40% for full nutrient management plan implementation.
2. Nutrient load reductions will be tracked using the PSNT test and the number of tons of manure sent to alternative uses such as composting and pelletization.

3. Cover Crop – Estimates of residual nutrient uptake (nitrogen only) and phosphorus not lost to erosion can be calculated and tracked for acres planted.

b) CREP Coordinator

Spatial locations of all CREP sites will be tracked in the NPS Program's Geographic Information System (GIS) at the 12 digit HUC code and/or TMDL load allocation scale using Access and ArcView GIS. Reductions of nitrogen, phosphorus, and sediment resulting from CREP vegetative plantings will be entered into EPA's GRTS on an annual or more frequent basis.

20) Water Quality Monitoring

Monitoring plans help determine the effectiveness of watershed projects which aim to improve TMDLs and water quality overall. As a result, it is important to institute tracking and monitoring systems to measure improvements in sub-watershed indicators over time. These systems include the internal tracking of the delivery of restoration projects in a sub-watershed, as well as monitoring of stream indicators at sentinel monitoring stations. Performance monitoring of individual restoration projects can be tracked to improve the design of future restoration practices. Information gathered from a tracking system is then used to revise or improve the restoration plan over a multi-year cycle.

The Watershed may experience significant change in land use if built out projections identified in the Baseline Assessment become reality. Monitoring plans for water quality improvement should take in to account the possibility of build out and the associated impacts. As a result, the following monitoring approaches are recommended:

a) Project Monitoring (Milestone Monitoring)

As warranted, small scale (reach or smaller) project monitoring will be conducted to illustrate benefits of individual restoration efforts. Project Managers will want to invest in both in-stream and non-stream monitoring of individual restoration projects to assist in measuring project success. Such monitoring can be relatively simple (observing the success of a reforestation project or measuring public awareness through surveys) or extremely complex and expensive (measuring the pollutant reduction of a storm water retrofit or the biological response to a comprehensive stream restoration project). Restoration practices are often experimental or implemented as demonstration projects, which sometimes makes it difficult to show improvement in overall water quality or watershed indicators. On an annual basis, information derived from the baseline and project monitoring should be compiled into a report.

The annual report should summarize current biological and physical conditions in the watershed; the number, type, and extent of projects taken; and the St. Jones success to date of the plan in improving watershed conditions. Reporting on an annual basis will allow for mid-course corrections and adjustments to be made based on the monitoring data.

b) Sentinel Stations

Sentinel monitoring stations are fixed, long-term monitoring stations which are established to measure trends in key indicators over many years. DNREC's Water Quality Monitoring stations

(GAMN) contain the history of data necessary to detect trends in water quality that would be beneficial to determine project success in removing targeted pollutants. These are the stations which TMDL data was calibrated. It is understood that data is currently being taken from the sites indicated, and that at a future time, depending on funding, the remaining sites may be monitored again. Other stations shown that could be utilized for future monitoring are STORET, USGS, and NPDES stations. A list of existing GAMN stations can be found in Table below.

St. Jones Watershed General Monitoring Network (GAMN) Stations

Site ID	Location	Sampling Activity
205031	2.5 Miles from Mouth	As needed
205041	3.5 upstream at Barkers Landing	6 times, Annually
205061	4.5 miles upstream at Gravel Pit	As needed
205091	Rt 10 Bridge near DAFB	6 times, Annually
205131	Rt 13 near Dover	As needed
205151	Rt 69 State College, Fork Branch	6 times, Annually
205171	Fork Branch at Riechold	As needed
205181	Rt 13 at Moores Lake	6 times, Annually
205191	Silver Lake Spillway	12 times, Annually
205201	Silver Lake at State Street	
205211	Derby Pond	6 times, Annually
205241	Isaacs Branch at Rt 13	As needed
205261	Derby Pond at Tidbury Creek	As needed
205271	Silver Lake, Fork Branch Rd	As needed
205321	Moores Lake, Isaacs Branch, at Rd 203	As needed
205571	Division Street	As needed
205581	Tidbury Creek at Rd 105	As needed
205591	Voshell Pond outfall	As needed
205601	Wyoming Pond outfall	As needed
205011	Bowers Beach, mouth of S. Jones River	12 times, Annually

If future funding allows, it is recommended to expand the GAMN station locations to include routine sampling of those station currently only monitored on an as needed basis. This would allow for data continuity and ease of collection. In addition, if additional point sources are discovered or added, downstream sampling sites should be added. Additionally, as warranted on a project specific basis, increase sampling will occur to measure and document BMP efficiency.

c) Illicit Discharge Monitoring

Illicit discharge detection and investigation are critical elements of watershed restoration and planning especially when there are obvious indicators of illicit discharges. Illicit discharges are often a significant source of pollution in a watershed that occurs repeatedly in association with specific polluting behaviors. The NPDES stations are areas where illicit discharges can be detected. Additionally, volunteer stream assessments which could be conducted yearly could identify potential illicit discharges.

d) Project Tracking

Create a routine spreadsheet or GIS system to track project data over time, such as project location, inspection, maintenance and performance. Project tracking data chronicles progress made in sub-watershed implementation, and can isolate management problems to improve the delivery of future restoration projects.

Performance standards for each project can be projected, tallied and a running record of reductions in pollutants to demonstrate measurable improvements toward the goals can be accomplished.

e) Volunteer Water Quality Monitoring

Water Quality Monitoring is crucial to our understanding of both existing conditions and the highly anticipated improvements in water quality as watershed implementation strategies mature. It is imperative that monitoring be permanent, that the findings be scientifically unassailable, and that such progress in water quality improvements be heralded. Sufficient funding is crucial to the success of this strategy. To supplement this long term monitoring, the NPS Program is eager to develop a water quality monitoring program that will integrate continuous monitoring technology through the routine GAMN Systems and add citizen monitoring using bioindicators that can be used to track pollution sources.

Milestones: 1 month after funds received – recruit participants, 3 months after funds received, train participants, citizen monitoring ongoing for months 3 – 24. Educational component: citizens hopefully will see improvements in water quality over time and be able to relate this to watershed plan.

f) Parameters

While the GAMN system of sampling varies by site locations, the following surface water quality parameters are included universally:

- Total Phosphorus
- Soluble Ortho-Phosphorus
- Ammonia Nitrogen
- Nitrite + Nitrite N
- Total Nitrogen
- Sediments
- Total Suspended Solids
- Secchi Depth
- Turbidity
- Field pH

- Conductivity
- Temperature
- Dissolved Oxygen
- Bacteria (Enterococcus)

A list of field measurements for the volunteer monitoring program would be much less extensive. However, field parameters and collection methods would be established to assure adequate measurement of both existing conditions and the improvements in water quality due to BMPs installation.

g) Reassessment of Watershed Status

On a regular basis (every 5-7 years) the Watershed should be reassessed. A reassessment should include a general overview of land use practices and land disturbance, wetlands, and streams to determine the longer term effects of project implementation or Watershed changes. Streams should be monitored where project implementation has occurred for buffer and stream condition (possibly with the rapid bio-assessment or the CWP Unified Stream Assessment). The reassessment should help refocus the Watershed Plan to keep the implementation and issues current with the existing issues in the future.

21) Implementation Strategy – Urban Component

a) Overview

The implementation strategies are broken into three approaches: ranking, technology, and sub-watershed.

- Ranking strategy utilizes the scores of each site to prioritize project implementation,
- Technology strategy utilizes prioritization based on individual technologies reviewed, and
- Sub-watershed strategy focuses on an individual sub-watershed with the highest potential to reap implementation benefits.

b) Ranking Basis

One strategy to implementing the identified opportunities is to develop a ranking of each of the opportunities identified and work from highest ranked to lowest ranked. Opportunities can be ranked in several ways. There are two major types of opportunities identified for the Watershed (Upland and WMWQ). The upland sites have been ranked by a High/Medium/Low ranking while the WMWQ sites have been ranked based on a scoring matrix. These sites have been ranked by their overall score and sub-scores for each technology. The upland rankings are included in Table 4 and the WMWQ scores in Table 5.

This strategy to implementation prioritization has the benefit of providing lists for different entities that may implement projects. As an example, municipalities may be more interested in upland opportunities and DNREC, Sussex County and regional groups may be more interested in the WMWQ sites. This strategy does not provide the potential entity to implement the projects an

understanding of how the site fits into more “holistic” or targeted approaches nor considers location within the Watershed.

c) Technology Basis

Another strategy to implementing identified opportunities is to develop a ranking and prioritization for the sites identified for each technology. As an example, all wetland restoration/creation sites would be compared to each other and scored and ranked. With this strategy an entity interested in implementing that technology could select the highest ranked site for that technology. There may be sources of funding that target specific technologies and this ranking will help support/justify the selection of particular sites for funding.

This strategy has the benefit of identifying most likely successful sites for a particular technology. However, this strategy does not provide the potential entity with an understanding of how the site fits into more “holistic” or targeted approaches nor considers location within the Watershed.

d) Sub-Watershed Basis

A preferred strategy for implementation would be to focus on strategies within sub-watersheds. Targeted multi-faceted improvements can have significant impact on water quality improvement. This strategy has the benefit of providing “holistic” approach to implementation and satisfies requirements for various funding sources. The identified pollution control opportunities have been sorted and ranked within each sub-watershed and are included in Tables 7, 8, 11, 12, 14, 15, 17, and 18. Rankings of WMWQ opportunities are provided as well as rankings of upland restoration opportunities. A ranking between the two types was not performed. As part of the sub-watershed basis strategy, a second level of prioritization is ranking/prioritizing the sub-watersheds for implementation. Based on the existing impairments, projected land use, and identified opportunities, the Silver Lake sub-watershed was identified as the best sub-watershed to initiate sub-watershed focused activities. The greatest gains in pollution control meeting the goals of the stakeholders appear to be possible for this sub-watershed.

e) Recommendations

Several strategies for implementation have been presented. Each has merits depending on specific goals and sources of funding. Watershed implementation strategies can be based on a variety of approaches depending on sources of impairments, land uses, funding availability, schedules, regulatory mandates and local objectives/values. Given the varied users and uses of the Implementation Plan, several strategies that would appear to meet the objectives for the St. Jones River Watershed are recommended. In general, strategies are suggested based on watershed wide criteria, sub-watersheds, and technologies. It is recommended that the sub-watershed approach be the preferred implementation strategy. Further, it is recommended that the Silver Lake Pond sub-watershed be the highest priority sub-watershed. Descriptions of the five recommended highest WMWQ and five recommended highest upland restoration opportunities are also attached as Attachment A. Attachment B includes a map of the entire St. Jones River Watershed with each of the opportunities identified. Highest priority opportunities are highlighted.

The Baseline Assessment indicated that Silver Lake has the greatest impervious cover, the least protected lands and the potential that urban growth could cover 20% of the Watershed in the future. This growth in urban land use will likely be accompanied by additional impervious cover and possible increase in pollutants entering the Watershed. The highest number (and greatest diversity in geographic location and type) of potential pollution control opportunities were identified for this sub-watershed. Significant preservation corridors for the two (2) main streams in the sub-watershed were also identified. Because of the future stressors this Watershed may experience, prioritization for implementing the identified opportunities for Silver Lake is recommended for consideration in the Implementation Strategy. The majority of upland and all of the WMWQ sites can be found on Attachment B.

St. Jones sub-watershed does not contain urban centers. Additionally, this sub-watershed has limited although potentially beneficial WMWQ improvement projects. The highest initial priority for this sub-watershed appears to be the potential preservation opportunities within the corridors identified. Tidbury Creek and Isaac Branch sub-watersheds are also projected for significant growth. Limited WMWQ sites were found in and around the Cities of Camden/Wyoming (downstream end of the sub-watersheds). There are no high ranking WMWQ sites in the headwaters where significant gains can be accomplished. Continued efforts for preservation and high priority (high return) urban retrofits are recommended for these sub-watersheds, in and around, the Cities of Camden/Wyoming.

Although the sub-watershed strategy is the recommended priority approach, it is also recommended to implement other high priority opportunities in other sub-watersheds as funding becomes available and willing land owners are identified. It is also recommended that specific high priority sites for preservation in each of the sub-watersheds be identified and subsequently evaluated for potential preservation/conservation opportunities.

